Chapter 5

Employment

Overview

This chapter examines the participation and employment characteristics of women, minorities, and persons with disabilities in the science and engineering labor force in 1995.[1] Representation is examined, in most cases, in terms of age, field of employment,[2] and highest degree level. These factors influence employment patterns; to the extent that men and women, minorities and nonminorities, and persons with and without disabilities differ on these factors, their employment patterns are likely to differ as well.

Within the science and engineering labor force, the age distributions of women compared to men, and of minorities compared to the majority, are quite different. Because large numbers of women and minorities have entered science and engineering fields only relatively recently, women and minority men are generally younger and have fewer years of experience. Age or stage in career is an influence on such employment-related factors as salary, rank, tenure, and work activity. Employment patterns also vary by field, and these field differences may influence employment in science and engineering jobs, unemployment, salaries, and work activities. Highest degree earned is also an important influence on employment, particularly on primary work activity and salary.

Women Scientists and Engineers

Representation in Science and Engineering

Women were slightly more than one-fifth (22 percent) of the science and engineering labor force, but close to half (46 percent) of the U.S. labor force in 1995. (See text table 1-1.) Although changes in the National Science Foundation (NSF) surveys do not permit analysis of long-term trends in employment, short-term trends show some increase in the representation of doctoral women in science and engineering employment: women were 22 percent of doctoral scientists and engineers in the United States in 1995 (see appendix table 5-1), compared with 20 percent in 1993 and 19 percent in 1991.[3]

Age Distribution

As will be seen, many of the differences in employment characteristics between men and women are partially due to differences in age. Women in the science and engineering workforce are younger, on average, than men: 18 percent of women and 12 percent of men employed as scientists and engineers were younger than age 30 in 1995. (See appendix table 5-2.)

Field of Science and Engineering

As is the case in degree fields (see chapters 3 and 4), women and men differ in field of employment. Women are more highly represented in some science and engineering fields than in others. For example, women are more than half of psychologists and 47 percent of sociologists, but 12 percent of physicists and 9 percent of engineers. (See figure 5-1 and appendix table 5-1.) Within engineering, women are also more highly represented in some fields than in others, for example, women are 13 percent of chemical and industrial engineers, but 6 percent of aerospace, electrical, and mechanical engineers.

Educational Background

Women scientists have, in many occupational fields, a lower level of educational attainment than men. In the science labor force as a whole, 15 percent of women and 21 percent of men hold doctoral

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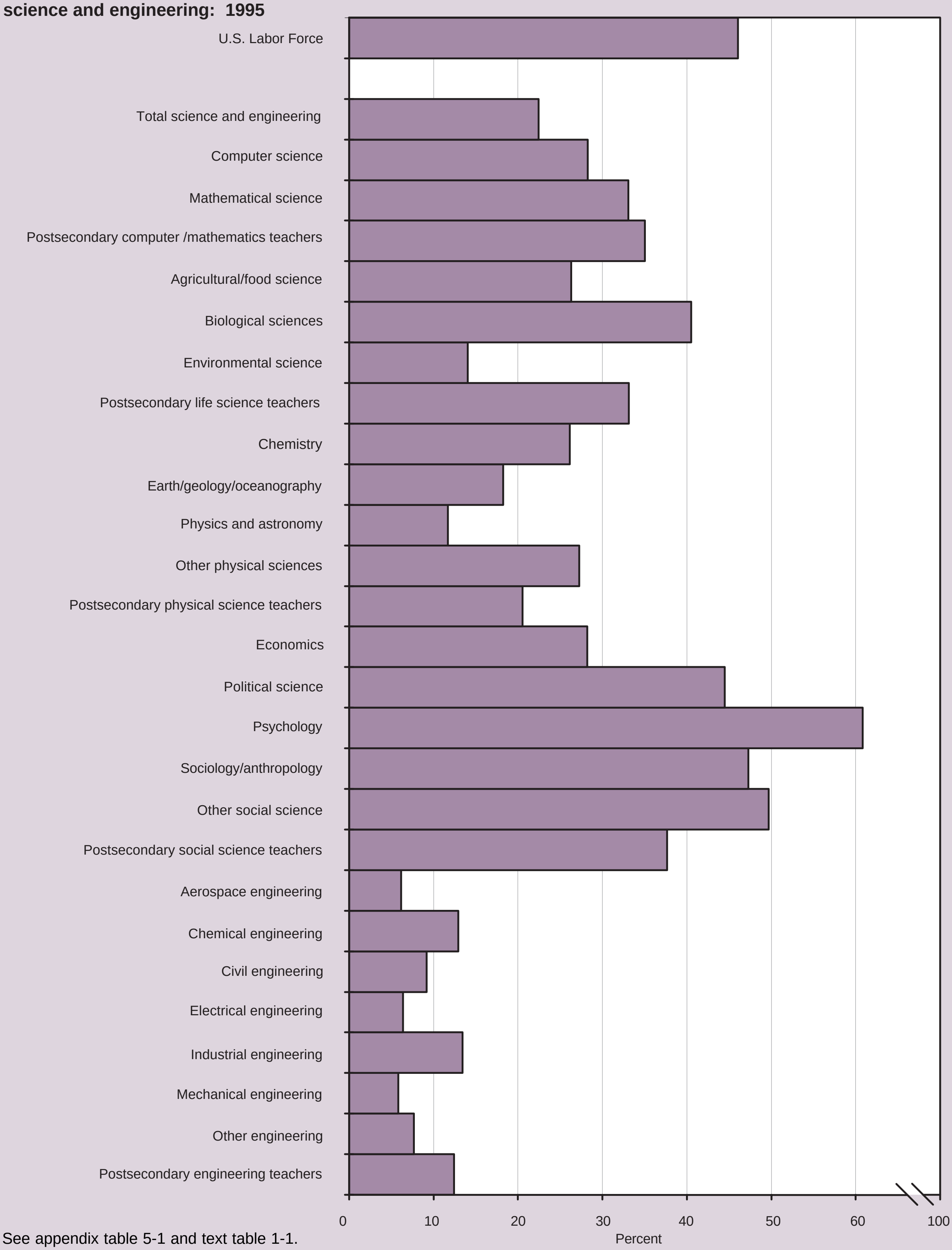
1 The data in this chapter are from the 1995 SESTAT Integrated Data Files—a combination of three NSF surveys measuring the employment, education, and demographic characteristics of scientists and engineers in the United States. The surveys were substantially revised in the 1990s and differ from those conducted in the 1980s in terms of the sample, design, question wording, and response rates. In most cases, therefore, it is not possible to present trend data.

2 Throughout this chapter, scientists and engineers are defined in terms of field of employment not degree field. See appendix A for the SESTAT classification of science and engineering and non–science-and-engineering fields.

3 For 1991 figures, see *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1994*, p. 95. For 1993 figures, see *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1996*, p. 63.

Figure 5-1.
Women as a percentage of the U.S. labor force and of the science and engineering labor force, by field of science and engineering: 1995



See appendix table 5-1 and text table 1-1.

degrees. (See appendix table 5-1.) In biology, 25 percent of women and 41 percent of men hold doctoral degrees; in chemistry, 13 percent of women and 27 percent of men hold doctoral degrees; and in psychology, 22 percent of women and 39 percent of men hold doctoral degrees. Differences in highest degree influence differences in the type of work performed, employment in science and engineering jobs, and salaries. In engineering, only about 5 percent of both men and women have doctoral degrees.

Labor Force Participation, Employment, and Unemployment

Men scientists and engineers are more likely than women to be in the labor force, to be employed full time and to be employed in their field of highest degree. Women are more likely than men to be out of the labor force, to be employed part time, and to be employed outside their field. Some of these differences are due to differences in the age distributions of men and women, and some are due to family-related reasons, such as demands of a spouse's job or presence of children.

The labor force participation rates of men and women with current or former science and engineering occupations are similar—87 percent of women and 88 percent of men are in the labor force. Conversely, 13 percent of women and 12 percent of men are not in the labor force (that is, not working and not seeking employment). Among those in the labor force, moreover, unemployment rates[4] of men and women scientists and engineers are similar: 2.0 percent of women and 2.2 percent of men were unemployed in 1995. (See appendix table 5-3.)

Overall similarities in labor force participation, however, mask differences within age groups. Although similar percentages of men and women are out of the labor force, the women who are out of the labor force are younger than the men who are out of the labor force. Most (60 percent) of the women who are out of the labor force are younger than age 45, but most (86 percent) of the men who are out of the labor force are age 55 or older.

Reasons for not working (whether out of the labor force or unemployed) differ in some respects by sex. Women were more likely than men to cite family responsibilities (40 percent versus 1 percent), and men were more likely than women to cite retirement (75 percent versus 21 percent). (See appendix table 5-4.) These differences reflect differences in the age distributions of men and women as well as differences in role responsibilities.

Women scientists and engineers were less likely than men to be employed full time in their field.[5] Of those who were employed, 74 percent of women and 86 percent of men were employed full time in their degree field. (See appendix table 5-3.) The fraction employed full time outside their degree field, however, was roughly similar for men and women: 10 percent of women and 9 percent of men were employed full time outside their degree field. For the most part, the reasons given for working outside their degree field were similar for both sexes: 36 percent of men and 37 percent of women cited pay or promotion opportunities and 23 percent of both cited change in career or professional interests. (See appendix table 5-5.) Women, though, were more likely than men to cite family-related reasons (for example, children, spouse's job moved) (7 percent versus 2 percent).

A major reason for the lower percentage of women scientists and engineers in full-time employment is their higher percentage in part-time employment. Of those who were employed, 16 percent of women and 5 percent of men were employed part time. (See appendix table 5-3.) Women who were employed part time were far more likely than men to cite family responsibilities as the reason. Forty-two percent of the women working part time and 7 percent of the men cited family responsibilities as the reason for working part time. (See appendix table 5-6.) Thirty-one percent of men and 4 percent of women cited retirement as the reason for part-time employment. As was the case with unemployment, the differences in age distribution of men and women, as well as differences in role responsibilities, account for these differences in reasons for part-time employment.

Sector of Employment

Within fields, women are about as likely as men to choose industrial employment. For example, among physical scientists, 54 percent of women and 50 percent of men are employed in business or industry. (See appendix table 5-7.) Among employed scientists and engineers as a whole, women are less likely than men to be employed in business or industry and are more likely to be employed in educational institutions: 50 percent of women and 65 percent of men are employed in for-profit business or industry and 26 percent of women and 15 percent of men are employed in educational institutions. These differences in sector,

[4] The unemployment rate is the ratio of those who are unemployed and seeking employment to the total labor force (that is, those who are employed plus those who are unemployed and seeking employment). Those who are not in the labor force (that is, those who are unemployed and not seeking employment) are excluded from the denominator.

[5] A respondent is employed "in field" if he or she responded that his or her current work is "closely related" or "somewhat related" to field of highest degree.

Is the Gender Gap in Unemployment Disappearing?

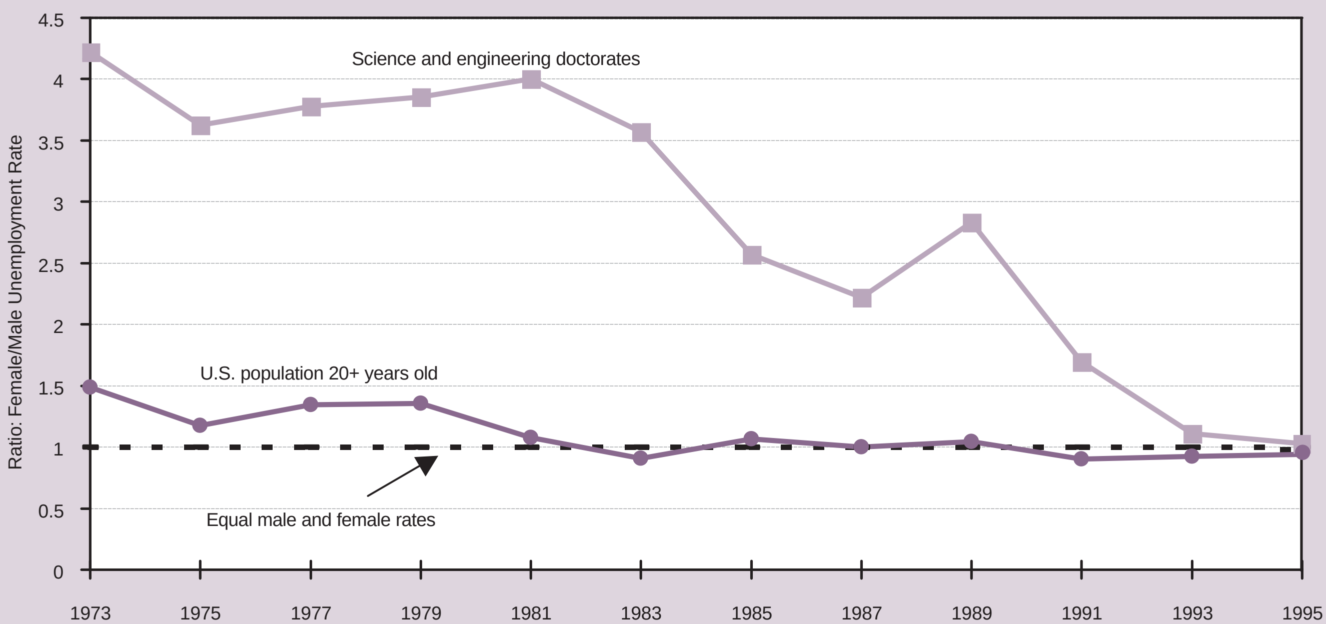
In 1995, the unemployment rate for both men and women who hold doctoral degrees in science and engineering was 1.5 percent. This figure is in stark contrast to the situation in 1973, when Maxfield et al. (1976, p. 5) found "the unemployment rate for women...substantially higher than that for men (3.9 percent versus 0.9 percent)." In the intervening years, the gender gap in unemployment, measured by the ratio of female to male unemployment, steadily narrowed. (See figure 5-2.)

Results of studies of the gender gap, controlling for other factors are consistent with the premise that the gender gap in unemployment among those with doctoral science and engineering degrees is disappearing. Maxfield et al. (1976) found that in 1973 in all age groups and all degree fields, women had considerably higher unemployment rates than men. The smallest reported difference was in the field of mathematics where the rate was 1.9 percent for women, compared to 1.4 percent for men. An NSF study of factors affecting unemployment in the 1993 doctoral science and engineering population (NSF, 1997) found no statistically significant difference between men and women, after controlling for such variables as field of degree and years since degree.

The vanishing gender gap in the doctoral science and engineering population is a reflection of a similar trend in the general population (U.S. Department of Labor, 1994, p. 32). In 1973, the unemployment rate for women in the general U.S. population age 20 and over was substantially higher (4.9 percent) than that for men (3.3 percent). The gender gap in the general population had been eliminated by the early 1980s, approximately a decade before its disappearance in the science and engineering doctoral population.

Figure 5-2.

Ratio of female to male unemployment rates of persons with doctoral degrees in science and engineering and persons 20 years of age and over in the overall population: 1973–1995



SOURCES: Doctoral statistics from National Science Foundation/SRS, Survey of Doctorate Recipients. General population figures from Bureau of Labor Statistics, Current Population Survey.

Preferences for Careers in Science and Engineering

Preferences for nonacademic, academic research, or academic teaching careers differ by sex and by field (Fox and Stephan, 1996). Preferences for academic research careers were found to be higher for men than for women, preferences for academic teaching careers were found to be higher for women than for men, and preferences for nonacademic careers did not differ by sex. These overall differences or similarities are confounded by field differences. Differences between men's and women's preferences for academic research careers were greatest in chemistry, microbiology, and computer science. Differences between men's and women's preferences for nonacademic careers, although nonexistent in the aggregate, were evident in computer science, electrical engineering, and physics. These findings are the result of a survey of 3,800 doctoral students in departments of chemistry, computer science, electrical engineering, microbiology, and physics in 1993–1994 of which 2,348 (62 percent) responded.

however, are mostly related to differences in field of degree. Women are less likely than men to be engineers or physical scientists, who tend to be employed in business or industry.

Academic Employment

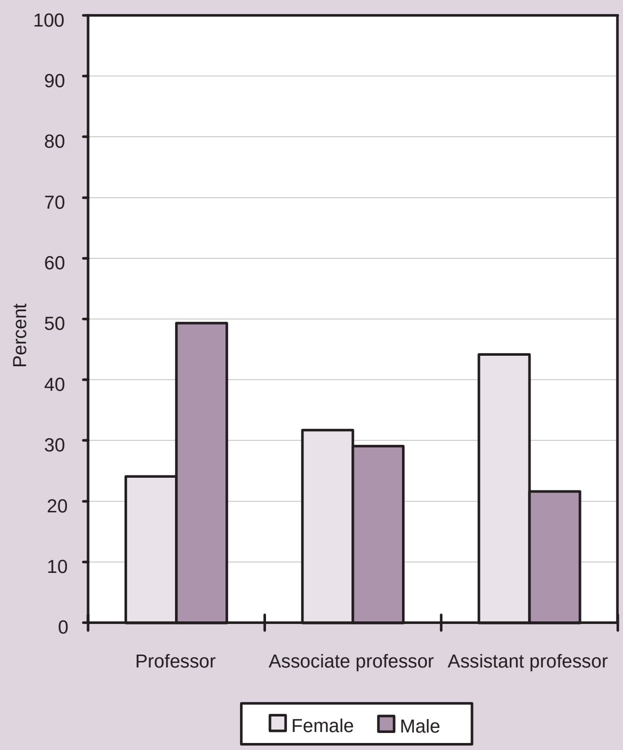
The career patterns of women in academic employment are quite different from those of men. Women differ from men in terms of type of school, rank, tenure, and research productivity. Among all scientists and engineers in academic employment, women are more likely than men to be employed in elementary or secondary schools (11 percent versus 4 percent) and in 2-year colleges (12 percent versus 9 percent). (See appendix table 5-8.)

In 4-year colleges and universities, women scientists and engineers hold fewer high-ranked positions than men. Women are less likely than men to be full professors and are more likely than men to be assistant professors. (See figure 5-3.) Among ranked science and engineering faculty, 49 percent of men and 24 percent of women are full professors. Part of this difference in rank can be explained by age differences, but differences in rank remain even after controlling for age. For example, among those ages 45 to 54, 40 percent of women and 61 percent of men are full professors. (See appendix table 5-9.)

Women are also less likely than men to be tenured. Thirty-five percent of full-time employed women science and engineering faculty are tenured, compared to 59 percent of men. As was the case with rank, some, but not all, of the differences in tenure may be attributable to differences in age. Among full-time employed science and engineering faculty ages 45 to 54, 57 percent of women and 76 percent of men are tenured. (See appendix table 5-10.)

Part of the difference in rank and tenure may be due to research productivity (as measured by number of publications). The most important factors influencing promotion in academia are time in rank and productivity (Long et al., 1993). Although roughly the same proportion of men and women had no publications (17 percent of women and 18 percent of men), women had fewer publications in refereed journals than men in the 5-year period 1990–1995. Among doctoral scientists and engineers who were employed full time in colleges or universities and who received their doctorates in 1990 or earlier, 45 percent of women and 34

Figure 5-3.
Academic rank of full-time employed ranked science and engineering faculty in 4-year colleges and universities, by sex: 1995



See appendix table 5-9.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

Do Men and Women Have Different Styles of Doing Science?

Some believe that gender influences the way scientists work and their choice of research subject (Sonnert and Holton, 1995a). This research suggests that many women follow a "niche" approach in selecting research problems—they create their own area of expertise rather than competing with other researchers in "hot" fields. Sonnert and Holton's interviews with 92 men and 108 women who had received postdoctoral fellowships in the sciences from NSF, the National Research Council, the Bunting Institute of Radcliffe College, or who had been Bunting finalists suggest that women may publish fewer papers because they take longer on a project, are more thorough and perfectionist, and take on broader projects than men. Women's articles have been found to have more citations per article than men's (Long, 1992; Garfield, 1993; Sonnert, 1995b.)

percent of men had one to five publications, and 38 percent of women and 48 percent of men had more than five publications. (See appendix table 5-11.) Differences in field as well as differences in age or years since doctorate are likely to explain some of the differences in publication rates.

Patent activity follows a pattern similar to publication activity: women are less likely than men to have patents. Among full-time employed doctoral natural scientists and engineers[6] who are employed in colleges or universities and who received their doctorates in 1990 or earlier, 7 percent of women and 11 percent of men had been named on applications for patents since 1990. (See appendix table 5-11.)

Differences in research support do not appear to be a factor in differences in publications and patents. Women faculty are as likely as men to be supported on Federal contracts or grants—44 percent of women and 45 percent of men faculty were supported by Federal contracts or grants. (See appendix table 5-12.)

Nonacademic Employment

Differences in field influence differences in primary work activities. For example, men are more likely than women to be engineers and physical scientists and are thus more likely to be engaged in research and development. Therefore, it is not surprising that the primary work activity of women scientists and engineers in business or industry differs from that done by men. For example, 28 percent of women and 40 percent of men report research and development as their primary work activity. Women, however, are as likely as men to be in management or administration—22 percent of men and 18 percent of women cite management or administration as their primary work activity.[7] (See appendix table 5-13.) Among those of similar ages, even less difference in managerial status is evident. For example, among scientists and engineers between the ages of 35 and 44, 19 percent of women and 21 percent of men are managers or administrators.

Although men and women of similar ages are about equally likely to be managers, men have more subordinates.[8] Women who are first-line supervisors have, on average, fewer total (direct plus indirect) subordinates than men. Women supervisors have, on average, 8 direct and indirect subordinates, whereas men have 12. (See appendix table 5-14.) This disparity in number of subordinates holds true among age groups as well.

The size of one's employer is an important factor in opportunities for promotion and advancement, salaries, and benefits. Potentially, employer size could explain some of the differences in opportunities and salaries experienced by men and women. Men and women scientists and engineers, however, do not differ in terms of employer size—4 percent of both work for very small firms (under 10 employees) and 44 percent of women and 45 percent of men work for large firms (5,000 or more employees.) (See appendix table 5-15.)

Publications are less important to one's career in business or industry than they are in academic employment. Almost half of both men and women PhDs employed in business or industry have no publications. Among doctoral scientists and engineers who were employed full time in business or industry and who received their doctorates in 1990 or earlier, 49 percent of women and 46 percent of men had no publications. Unlike the case in academic employment, women in business or industry have as many publications in

[6] The prevalence of patents by social scientists was so low they were excluded from this analysis.

[7] This difference is not statistically significant.

[8] It should be noted that in the SESTAT data files, only first-line supervisors are considered scientists and engineers. Midlevel and top managers and administrators are not considered to be in science and engineering occupations. Because this analysis was limited to people employed as scientists and engineers, those midlevel and top managers and administrators were excluded.

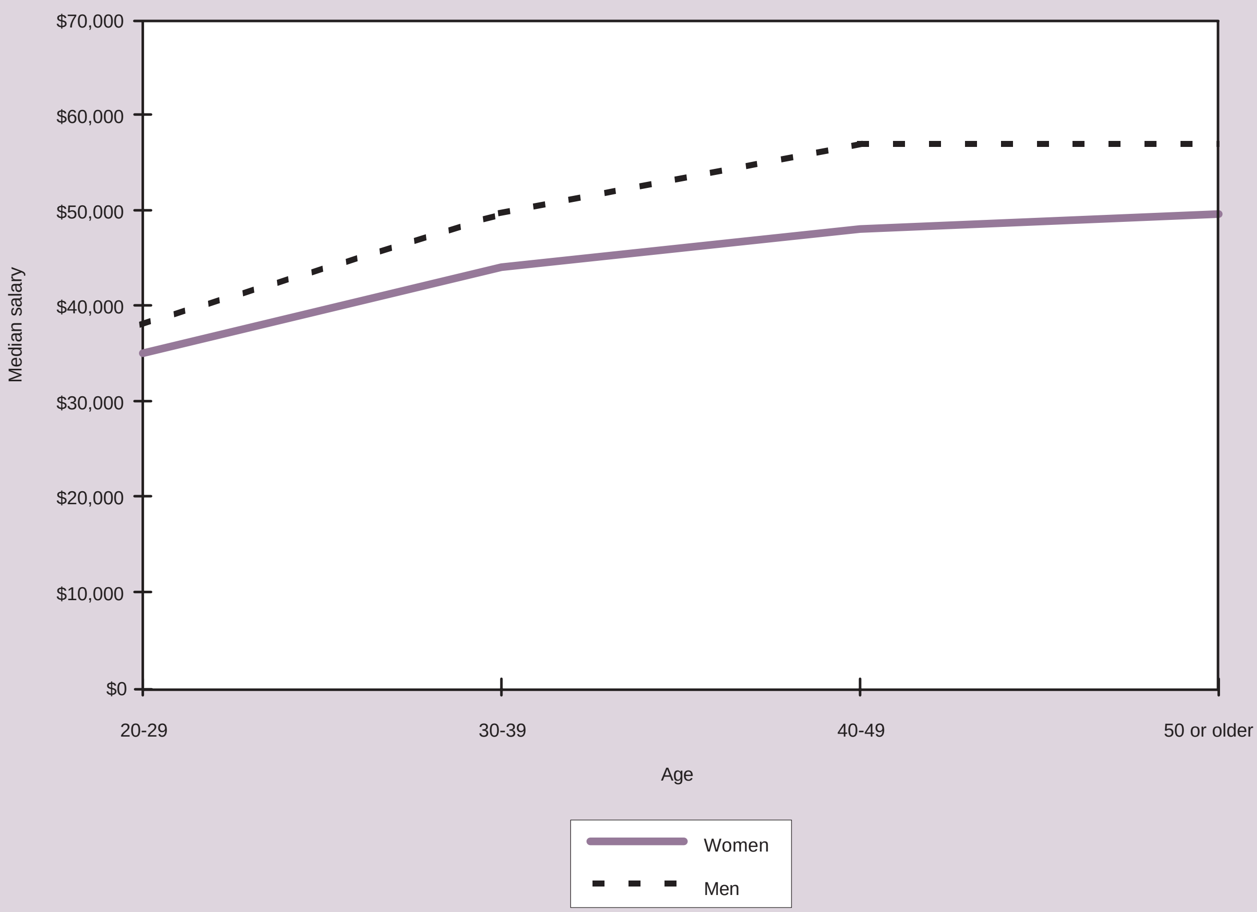
refereed journals as men: 14 percent of women and 15 percent of men had more than five publications. (See appendix table 5-16.)

In contrast to publications, patents are of greater importance among scientists and engineers employed in industry. Women, though, are less likely than men to have patents. Among natural scientists employed in business or industry in 1995, 28 percent of women and 39 percent of men had been named on applications for patents since 1990. (See appendix table 5-16.)

Salaries

Full-time employed women scientists and engineers generally earn less than men, but differences in salary by gender are due primarily to differences in age and field. Women scientists and engineers are younger, on average, than men and are less likely than men to be in computer science or engineering, fields which command higher salaries. The overall median salary for women ($42,000) is much lower than that for men ($52,000) but within fields and within younger age categories, the median salaries of men and women vary considerably, but are more nearly the same. (See appendix table 5-17.) For example, among computer and mathematical scientists with bachelor's degrees between the ages of 20 and 29, the median salary for women was $35,000, and for men it was $38,000 in 1995. With increasing age, however, the gap in salaries of men and women widens. (See figure 5-4.) For example, among computer and mathematical scientists with bachelor's degrees between the ages of 40 and 49, the median salary for women was $48,000 and for men was $57,000. The lesser prevalence of women in higher positions in academe and industry explains some

Figure 5-4.
Median annual salaries of bachelor's computer scientists, by sex and age: 1995



See appendix table 5-17.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

of this difference. Comparisons of men and women in the same field, the same age group, the same rank or position, and with a similar number of subordinates, would reveal salaries more nearly the same. See the previous version of this report (NSF, 1996) for a more detailed explanation of the influences on salaries for men and women.

Minority Scientists and Engineers[9]

Representation in Science and Engineering

With the exception of Asians, minorities are a small proportion of scientists and engineers in the United States. Asians were 10 percent of scientists and engineers in the United States in 1995, although they were 3 percent of the U.S. population. Blacks, Hispanics, and American Indians as a group were 23 percent of the U.S. population and 6 percent of the total science and engineering labor force in 1995.[10] Blacks and Hispanics were each about 3 percent, and American Indians were less than half of 1 percent of scientists and engineers. (See figure 5-5.)

Age Distribution

The age distributions of minorities, including Asians, differ from that of white scientists and engineers. As noted earlier, these differences influence differences in employment characteristics. About 13 percent of employed white scientists and engineers are younger than age 30, compared with between 16 and 20 percent of Asian, black, and Hispanic scientists and engineers. (See appendix table 5-2.)

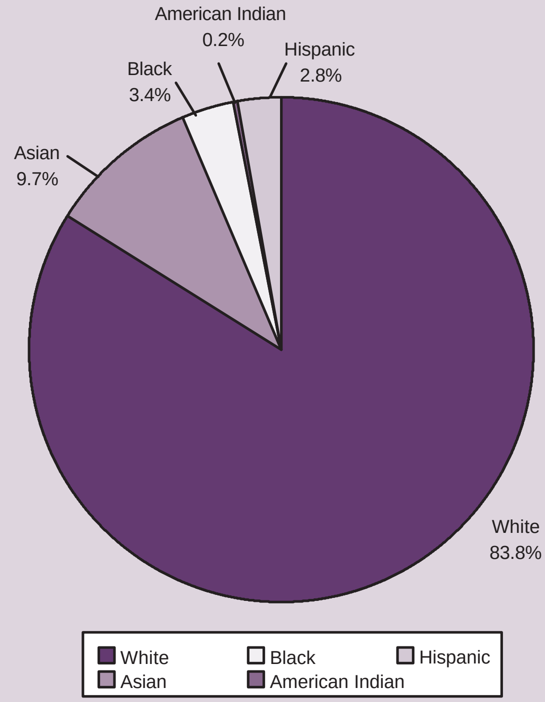
Field of Science and Engineering

Black, Asian, and American Indian scientists and engineers are concentrated in different fields than white and Hispanic scientists and engineers. (See figures 5-6 to 5-10.) Asians are less represented in social sciences than they are in other fields. They are 4 percent of social scientists but 10 percent of engineers and computer scientists. A higher proportion of black scientists and engineers are in social sciences and in computer and mathematical sciences than they are in other fields. They are 5 percent of social scientists, 4 percent of computer and mathematical scientists, and roughly 3 percent of physical scientists, life scientists,

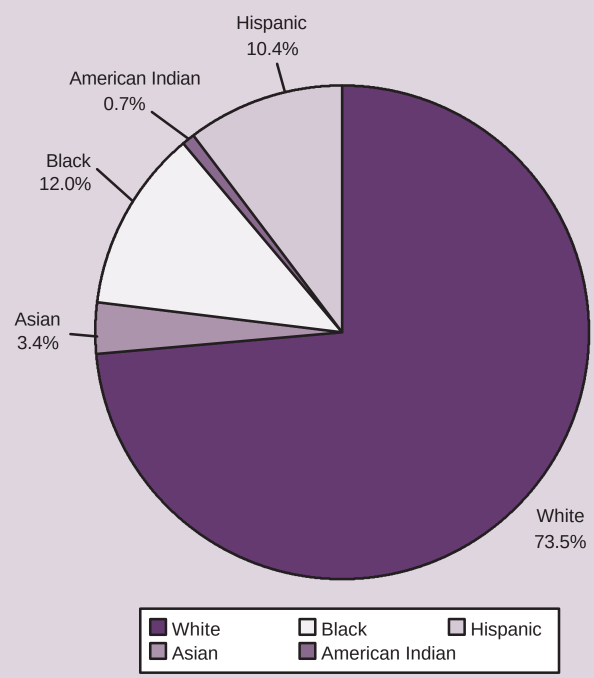
[9] The data reported in this section include all scientists and engineers, regardless of citizenship or country of origin, unless otherwise noted.

[10] The science and engineering field in which blacks, Hispanics, and American Indians earn their degrees influences participation in the science and engineering labor force. Blacks, Hispanics, and American Indians are disproportionately likely to earn degrees in the social sciences (defined by NSF as degrees in science and engineering) and to be employed in social services occupations, e.g., social worker, clinical psychologist, that are defined by NSF as non–science-and-engineering occupations. See appendix A for NSF's classification of science and engineering fields.

Figure 5-5.
Scientists and engineers in the labor force, by race/ethnicity: 1995



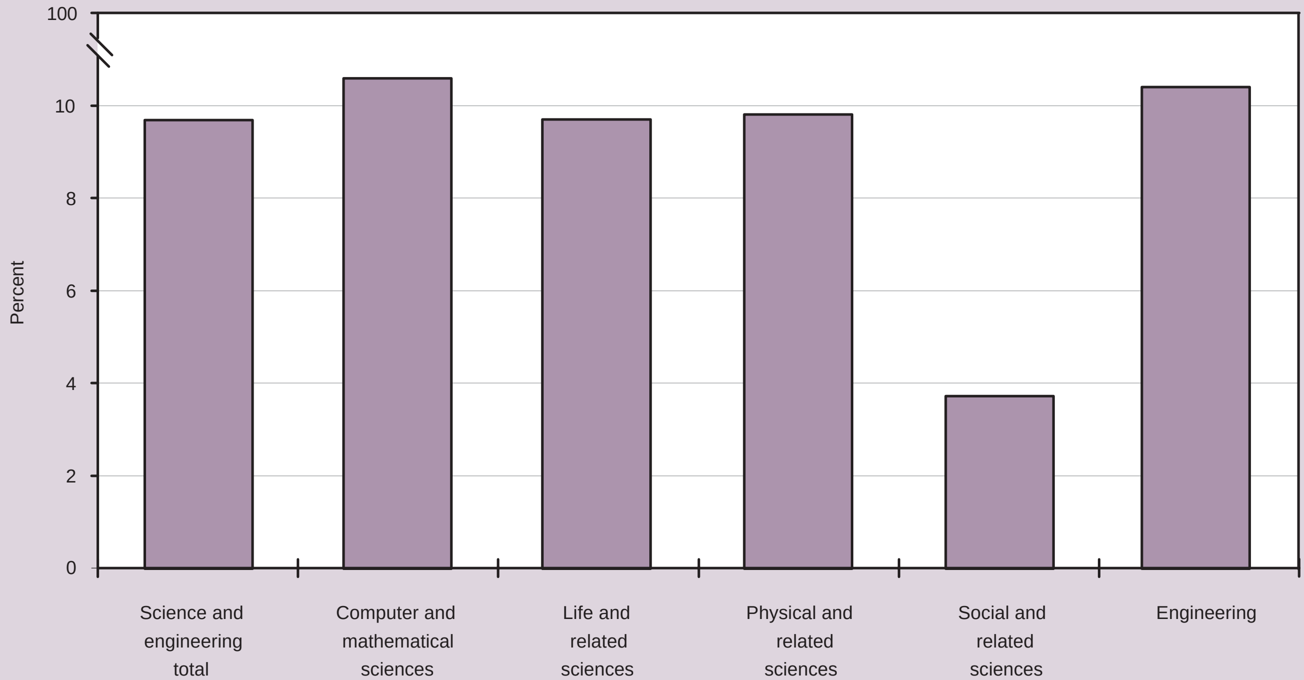
The resident population of the United States, by race/ethnicity: 1995



See text table 1-1.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

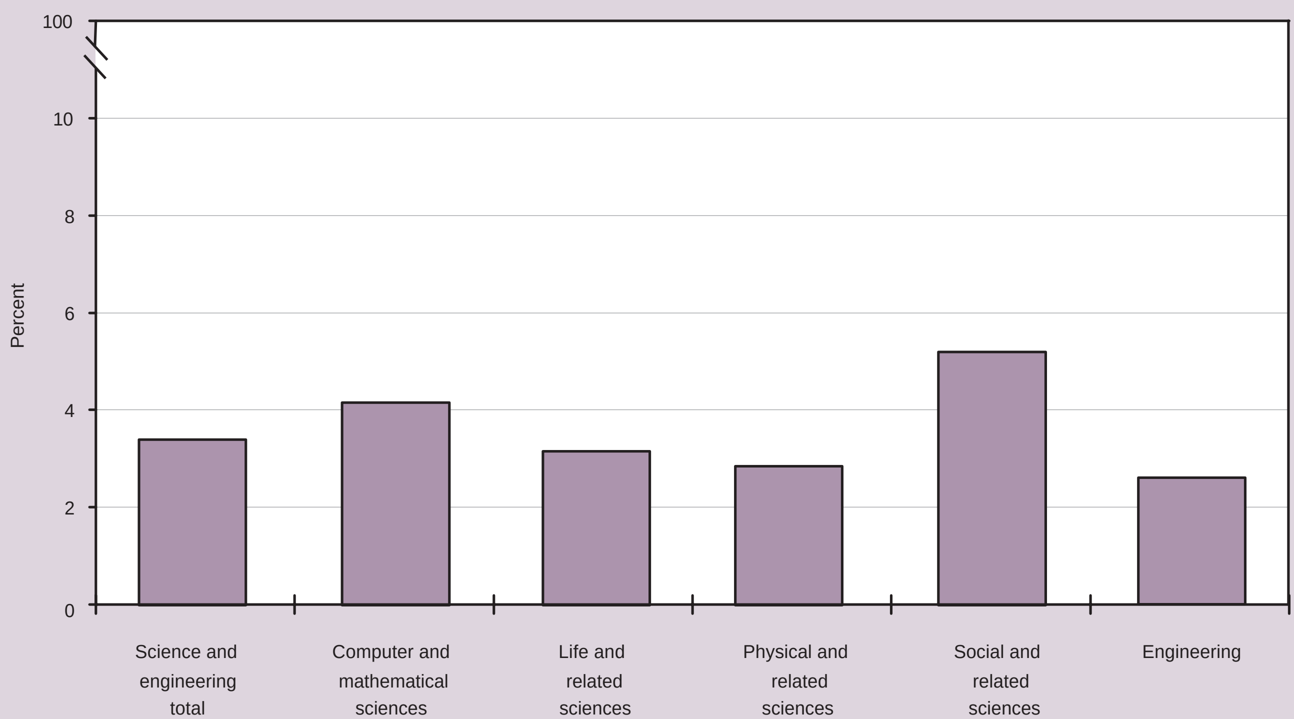
Figure 5-6.
Asians as a percentage of the science and engineering labor force, by occupation: 1995



See appendix table 5-18.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

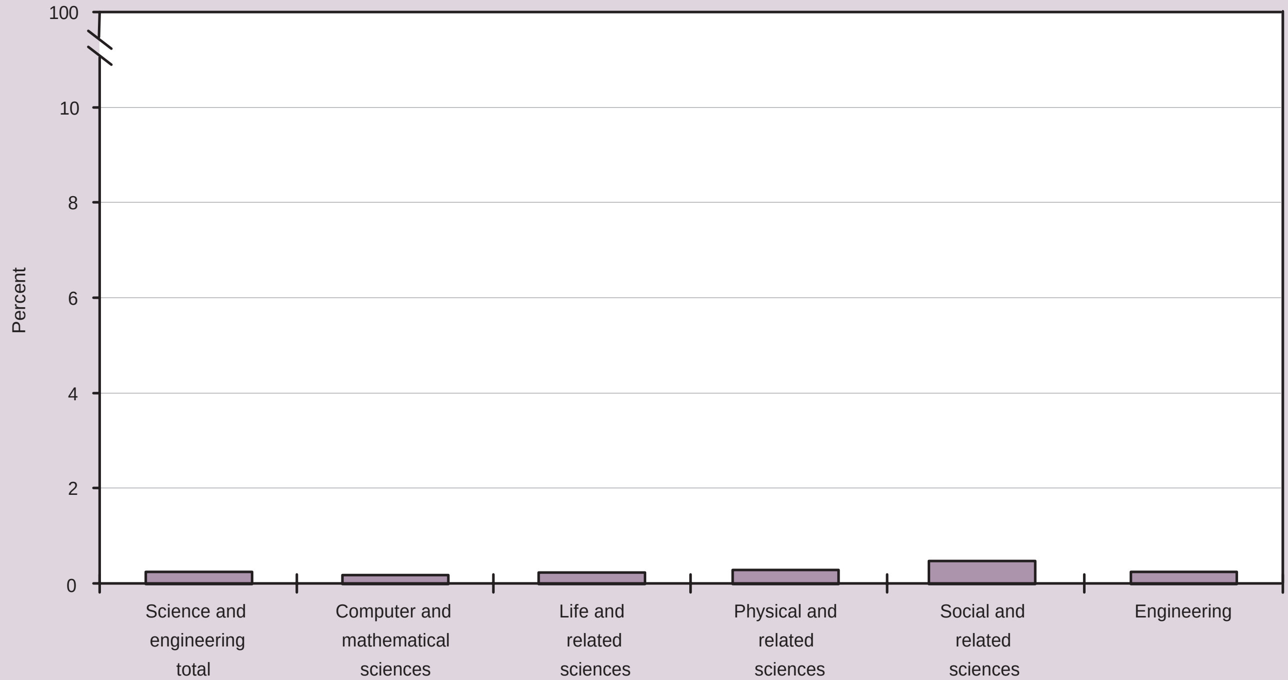
Figure 5-7.
Blacks as a percentage of the science and engineering labor force, by occupation: 1995



See appendix table 5-18.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

Figure 5-8.
American Indians as a percentage of the science and engineering labor force, by occupation: 1995



See appendix table 5-18.

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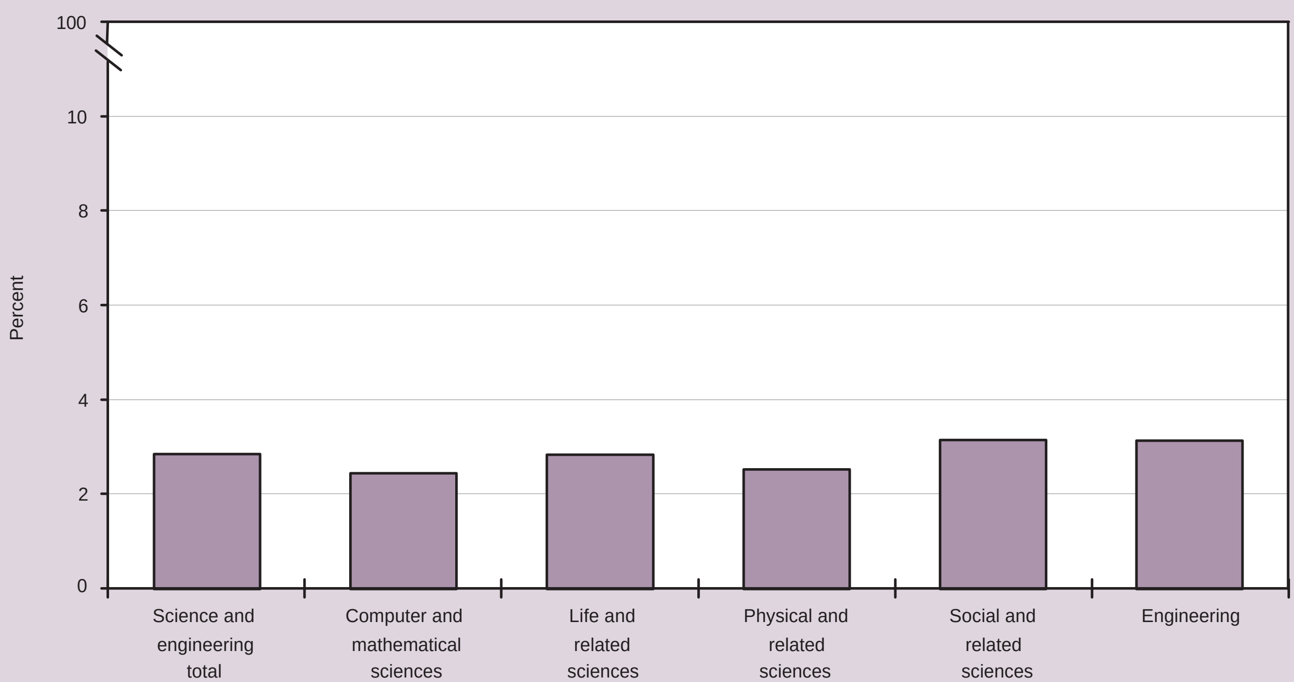
Figure 5-9.
Hispanics as a percentage of the science and engineering labor force, by occupation: 1995



See appendix table 5-18.

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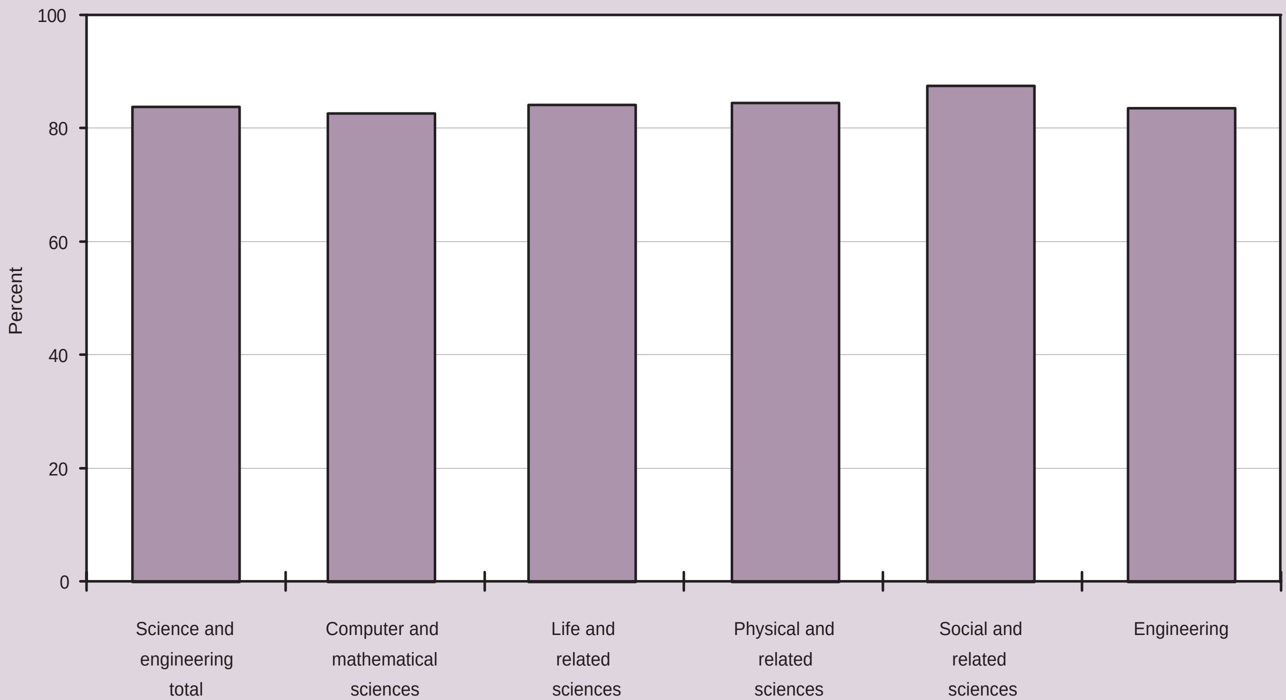
Figure 5-10.
Whites as a percentage of the science and engineering labor force, by occupation: 1995



See appendix table 5-18.

Women, Minorities, and Persons With Disabilities in Science and Engineering: 1998

and engineers. Although the numbers are small, American Indians appear to be concentrated in the social sciences. They are 0.5 percent of social scientists and 0.3 percent or less of other fields. Hispanics are more proportionally represented among fields. They are roughly 2.5 to 3 percent of scientists and engineers in each field.

Distributions of field for racial/ethnic groups differ also by nativity. Among doctoral scientists and engineers, U.S.-born Asians are more similar to other racial/ethnic groups in terms of field than are non-U.S.-born Asians. (See text table 5-1.) Both U.S.-born and non-U.S.-born Asians are less likely than other racial/ethnic groups to be in social sciences and more likely to be in engineering; however, the differences are less among U.S.-born scientists and engineers. (See appendix table 5-19.)

Educational Background

The educational attainment of scientists and engineers differs among racial/ethnic groups. Black scientists and engineers have, on average, a lower level of educational attainment than scientists and engineers of other racial/ethnic groups. Black scientists and engineers are more likely than white, Hispanic, or Asian scientists and engineers to have a bachelor's as the terminal degree: 66 percent of black scientists and engineers in the U.S. labor force have a bachelor's as the highest degree compared to 58 percent of all scientists and engineers in 1995. (See appendix table 5-18.)

Labor Force Participation, Employment, and Unemployment

Labor force participation rates vary by race/ethnicity. Minority scientists and engineers were more likely than whites to be in the labor force (i.e., employed or looking for employment). Between 91 and 94 percent of black, Asian, Hispanic, and American Indian scientists and engineers were in the labor force in 1995, compared to 87 percent of white scientists and engineers. (See appendix table 5-20.) Age differences are part of the explanation. White scientists and engineers are older, on average, than scientists and engineers of other racial/ethnic groups: 22 percent of white scientists and engineers were age 50 or older in 1995, compared with between 15 and 18 percent of Asians, blacks, and Hispanics. (See appendix table 5-2.) Among those in similar age groups, the labor force participation rates of white and minority scientists and engineers are similar. (See appendix table 5-3.)

Text table 5-1.
Doctoral scientists and engineers in the labor force, by occupation and race/ethnicity: 1993

U.S.-born doctoral scientists and engineers:
[Percentage distribution]

Occupation	Total	White, non-Hispanic	Asian	Black, non-Hispanic	Hispanic	American Indian
Total, all fields	100.0	100.0	100.0	100.0	100.0	100.0
Computer and mathematics	11.6	11.6	9.5	12.7	10.0	9.2
Life sciences	24.7	24.8	32.1	19.2	22.7	17.0
Physical sciences	18.5	18.8	15.5	11.3	16.3	9.5
Social sciences	31.6	31.2	23.9	49.2	35.1	54.8
Engineering	13.6	13.6	19.0	7.6	16.0	9.4

Non-U.S.-born doctoral scientists and engineers:
[Percentage distribution]

Occupation	Total	White, non-Hispanic	Asian	Black, non-Hispanic	Hispanic	American Indian
Total, all fields	100.0	100.0	100.0	100.0	100.0	—
Computer and mathematics	16.5	17.0	16.2	12.7	15.4	—
Life sciences	24.0	24.2	23.5	21.0	29.8	—
Physical sciences	20.2	21.9	19.3	20.5	15.8	—
Social sciences	12.7	17.2	7.7	26.4	22.0	—
Engineering	26.6	19.7	33.3	19.3	17.0	—

See appendix table 5-19.

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Although minorities, for the most part, are less likely to be out of the labor force, among those who are in the labor force, minorities are more likely to be unemployed. In 1995, the unemployment rate of white scientists and engineers was significantly lower than that of other racial/ethnic groups. (See appendix table 5-20.) The unemployment rate for whites was 2.0 percent, compared with 2.8 percent for Hispanics, 2.4 percent for blacks, and 3.4 percent for Asians. The differences in unemployment rates were evident within fields of science and engineering as well as for science and engineering as a whole. For example, the unemployment rate for white engineers was 2.5 percent; for black and Asian engineers, it was 4.0 percent.

Sector of Employment

Racial/ethnic groups differ in employment sector, partly because of differences in field of employment. Among employed scientists and engineers in 1995, 51 percent of black, 57 percent of Hispanic, and 54 percent of American Indian, compared with 62 percent of white and 64 percent of Asian scientists and engineers were employed in for-profit business or industry. (See appendix table 5-7.) Blacks and American Indians are concentrated in the social sciences, which are less likely to offer employment in business or industry, and are underrepresented in engineering, which is more likely to offer employment in business or industry. Asians, on the other hand, are overrepresented in engineering and thus are more likely to be employed by private for-profit employers.

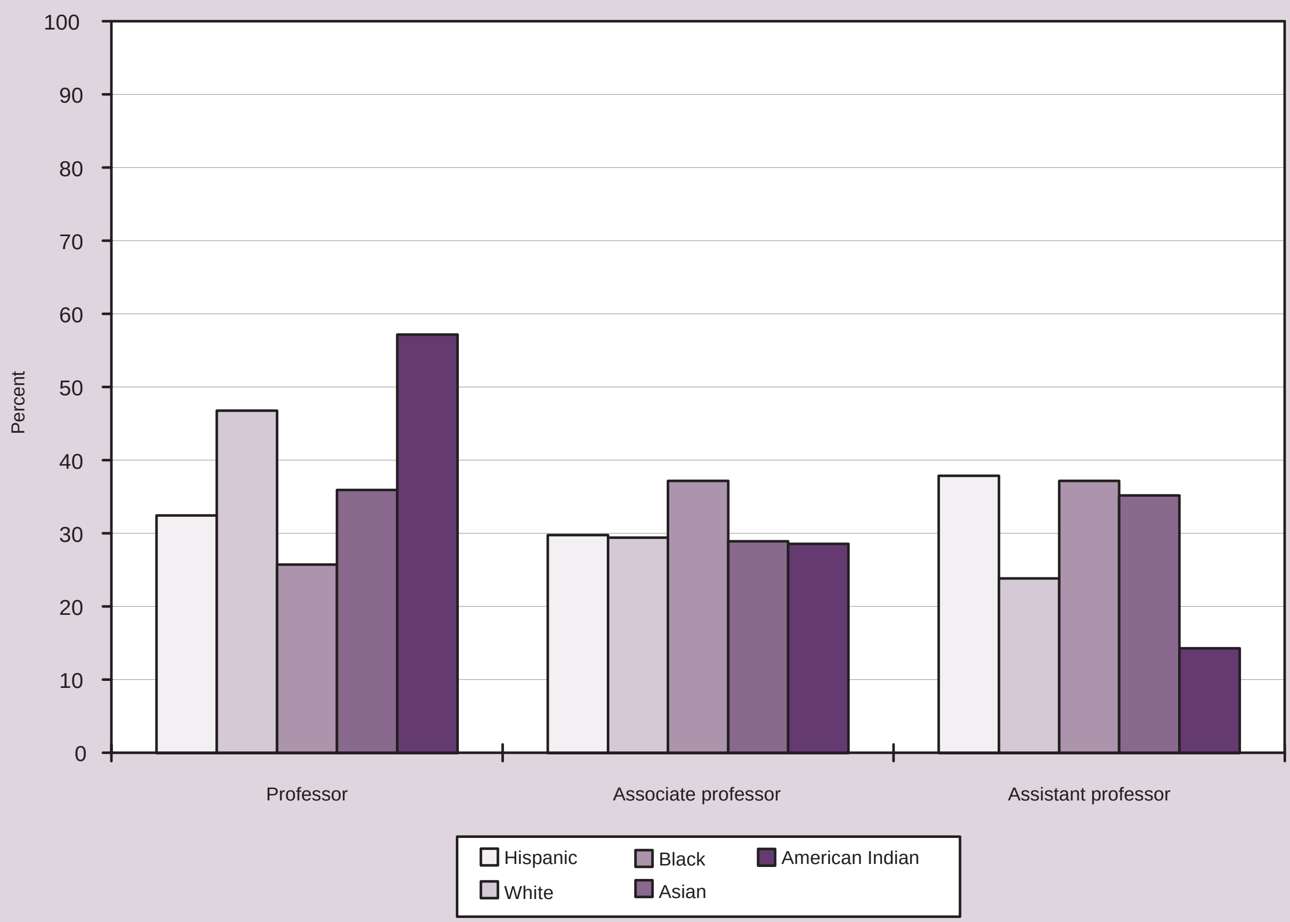
Black, Hispanic, and American Indian scientists and engineers are also more likely than other groups to be employed in government (Federal, state, or local): 22 percent of black, 17 percent of Hispanic, and 19 percent of American Indian scientists and engineers were employed in government in 1995, compared with 14 percent of white and 12 percent of Asian scientists and engineers.

Academic Employment

Racial/ethnic groups differ in academic employment characteristics such as rank and tenure. Minorities represented 15 percent of full-time ranked doctoral science and engineering faculty in 1995: blacks constituted 2.4 percent, Asians 9.2 percent, American Indians 0.5 percent, and Hispanics 2.7 percent. Although Asians are not underrepresented in science and engineering employment, like underrepresented minorities, they are less likely to be full professors. (See figure 5-11.) Among full-time ranked science and engineering faculty, 35 percent of Asians, 25 percent of blacks, and 31 percent of Hispanics, compared with 47 percent of whites, are full professors. These differences are largely explained by differences in age. Black, Hispanic, and Asian scientists and engineers are younger on average than white and American Indian scientists and engineers. When age differences are accounted for, most differences in rank and tenure are reduced. Among ranked faculty between the ages of 45 and 54, 50 percent of Hispanic faculty, 55 percent of Asian faculty and 59 percent of white faculty were full professors. (See appendix table 5-9.) Among black faculty in that age group, however, 25 percent were full professors.

Black, Hispanic, and Asian faculty are also less likely than white faculty to be tenured. Forty-seven percent of black faculty, 41 percent of Hispanic faculty, and 35 percent of Asian faculty compared to 57 percent of white faculty are tenured. (See appendix table 5-10.) Some, but not all, of these tenure differences are related to age differences. Among younger faculty (age 35 to 44), 29 percent of Hispanic, 21

Figure 5-11.
Academic rank of full-time employed ranked doctoral science and engineering faculty in 4-year colleges and universities, by race/ethnicity: 1995



See appendix table 5-9.

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percent of black, 25 percent of Asian, and 37 percent of white faculty are tenured.

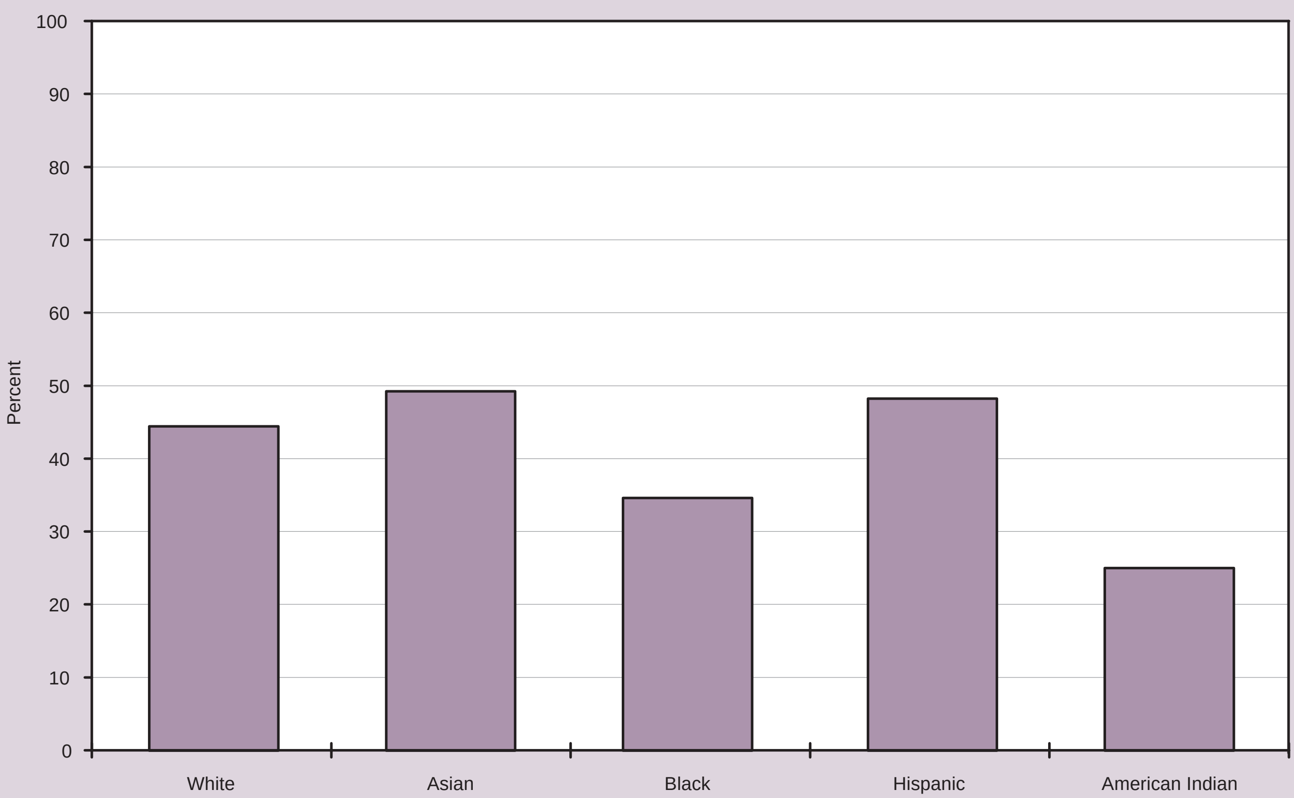
Black faculty had fewer publications than faculty in other racial/ethnic groups since 1990. (See appendix table 5-11.) Among doctoral scientists and engineers who received their doctorates in 1990 or earlier and who work in 4-year colleges or universities, 28 percent of black faculty had no publications since 1990 compared with 15 percent of Hispanic, 18 percent of white, and 12 percent of Asian faculty.

Black and American Indian faculty are also less likely than other groups to have received Federal grants or contracts. (See figure 5-12.) Thirty-five percent of black and 25 percent of American Indian doctoral scientists and engineers employed in colleges or universities are supported by Federal contracts or grants compared to 44 percent of white and 49 percent of Hispanic and Asian doctoral scientists and engineers employed full time in colleges or universities. (See appendix table 5-12.)

Nonacademic Employment

Racial/ethnic groups differ in some respects in their primary work activity. Black and Asian scientists and engineers are more likely than other groups to be engaged primarily in computer applications—34 percent of black and 36 percent of Asians compared with 27 percent of Hispanic and 28 percent of white scientists and engineers. (See appendix table 5-13.) Asians are less likely than other groups to be in management or administration (14 percent of Asians compared with roughly 22 percent of Hispanic, white, and black scientists and engineers). Age differences do not explain this difference in managerial activity. Among 35 to 44 year olds, Asians remain less likely to be in management—13 percent of Asians and between 20 and 23 percent of other groups are in management or administration. Among supervisory scientists and engineers, Asians also have fewer subordinates. The average number of direct and indirect subordinates is 8 for Asians,

Figure 5-12.
Percent of full-time employed doctoral scientists and engineers in 4-year colleges or universities who are supported by contracts or grants from the U.S. government, by race/ethnicity: 1995



See appendix table 5-12.

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9 for American Indians, and roughly 11 for Hispanic, white, and black scientists and engineers. (See appendix table 5-14.)

White and Hispanic scientists and engineers work for similarly sized employers. Black and American Indian scientists and engineers are more likely to work for very large firms (55 percent and 54 percent, respectively) than are white scientists and engineers (45 percent). (See appendix table 5-15.)

Black scientists and engineers are less likely to have patents than other racial/ethnic groups. In business and industry among natural scientists and engineers who received degrees in 1990 or earlier, 17 percent of blacks, compared with 50 percent of Hispanics, 38 percent of whites, and 36 percent of Asians, were named as an inventor on a patent since 1990. (See appendix table 5-16.)

Salaries

Salaries for scientists and engineers differ little among racial/ethnic groups. Among all scientists and engineers, the median salaries by racial/ethnic group are $50,500 for whites, $50,000 for Asians, $45,000 for blacks, $47,000 for Hispanics, and $48,000 for American Indians, with the biggest differences being between whites and blacks. Within fields and age categories, median salaries of scientists and engineers by race/ethnicity are not dramatically different and do not follow a consistent pattern. (See appendix table 5-21.) For example, the median salary of engineers with bachelor's degrees who are between the ages of 20 and 29 ranges from $36,000 for American Indians to $40,000 for blacks. Among those between the ages of 40 and 49, the median salary ranges from $53,000 for Asians and Hispanics to $58,000 for whites.

Minority Women

Representation in Science and Engineering

Minority women are 19 percent of all women in the science and engineering labor force and 4.2 percent of all scientists and engineers in the labor force. (See text table 1-1 and appendix table 5-22.) Black women are 1.3 percent, Hispanic women are 0.6 percent, American Indian women are 0.1 percent, and Asian women are 2.2 percent of scientists and engineers in the labor force. Within every racial/ethnic group, women are a smaller proportion of the science and engineering labor force than are men.

Field of Science and Engineering

Field choices of minority women are more similar to those of white women than they are to those of minority men. Higher proportions of women than men within each racial/ethnic group are in computer or mathematical sciences, life sciences, and social sciences and lower proportions are in engineering. Asian women differ from women in other racial/ethnic groups in that a relatively small proportion are in social sciences. (See appendix table 5-22.)

Labor Force Participation, Employment, and Unemployment

Black and Asian women scientists and engineers are more likely than women from other racial/ethnic groups to be in the labor force and to be employed full time in a field related to their degree. Seventy-one percent of black and 72 percent of Asian women scientists and engineers compared with 61 percent of white women, 68 percent of Hispanic women, and 65 percent of American Indian women were employed full time in their field. (See appendix table 5-23.) Conversely, more white women (15 percent) than black women (9 percent) and Asian women (7 percent) are employed part time.

The unemployment rate for white women scientists and engineers is much lower than is the case for other racial/ethnic groups: 1.8 percent compared with 2.3 percent for Hispanic women, 2.7 percent for black women, and 3.0 percent for Asian women.

Sector of Employment

Academic Employment

As previously discussed, men and women and racial/ethnic groups differ in academic employment characteristics, such as rank and tenure. Women are less likely than men to be full professors, and minority faculty are less likely than white faculty to be full professors. Minority women are less likely than white women and less likely than men of any racial/ethnic group[11] to be full professors. (See appendix table 5-24.) As in other cases, these rank and tenure differences may be related to age differences.

Tenure differences may also be related to rank. Minority women are less likely than white women or men of any racial/ethnic group to be tenured. Twenty-five percent of Hispanic women, 36 percent of black women, and 17 percent of Asian women compared to 38 percent of white women, 62 percent of white men, and between 39 and 50 percent of Hispanic, black and Asian men are tenured. (See appendix table 5-25.) The small percentage of Asian women who are tenured is also related to differences in academic position. A relatively larger proportion of Asian men and women are in positions for which tenure does not apply, for example, postdoctoral fellows and nonfaculty research appointments.

[11] Excluding American Indians for whom data are unreliable due to small sample size.

Nonacademic Employment

Minority women scientists and engineers in business or industry have, for the most part, similar work activities as white women and minority men. For example, from 26 to 34 percent of women in most racial/ethnic groups are primarily engaged in research, and from 17 to 21 percent of women in most racial/ethnic groups are in management or administration (the exception being 13 percent of Asian women in management). (See appendix table 5-26.) Women, regardless of racial/ethnic group, are more likely than men to work in computer applications and are less likely than men to work in research and development.

Salaries

Median annual salaries of minority women are similar to those of both white women and minority men, controlling for field and age. Among engineers in the 20- to 29-year-old age group, for example, the median salary of Hispanic women was $40,000, for black women $42,000, for Asian women $37,700, and for white women $38,800. Median salaries for men engineers in the same age group ranged from $38,000 to $40,000. (See appendix table 5-27.)

Scientists and Engineers With Disabilities

Representation in Science and Engineering

Persons with disabilities are also underrepresented in science and engineering occupations. Comparisons of data on participation of persons with disabilities are difficult because of differences in definition.[12] It appears, however, that persons with disabilities are a smaller proportion of the science and engineering labor force than they are of the labor force in general. About 20 percent of the U.S. population have some form of disability, and about 10 percent have a severe disability[13] (McNeil, 1993). Persons with disabilities are 14 percent of all employed persons[14] and 5 percent of employed scientists and engineers. (See text table 1-1 and appendix table 5-7.)

The representation of persons with disabilities in the science and engineering population can be estimated by comparing the results of the NSF SESTAT surveys with similar results from the Bureau of the Census Survey of Income and Program Participation (SIPP).[15] The 1993–1994 SIPP used

[12] The data on persons with disabilities in science and engineering are seriously limited for several reasons. First, there have been differing operational definitions of "disability" that include a wide range of physical and mental conditions. Different sets of data have used different definitions and thus are not totally comparable. Second, data about disabilities are frequently not included in comprehensive institutional records (e.g., in registrars' records in institutions of higher education). The third limitation on information on persons with disabilities gathered from surveys is that it often is obtained from self-reported responses. Typically, respondents are asked if they have a disability and to specify what kind of disability it is. Resulting data, therefore, reflect individual decisions to self-identify, not objective measures. Finally, data users should understand that sample sizes for the population of disabled persons may be small and care should be taken in interpreting the data.

[13] Estimates of the proportion of the population with disabilities vary due to differing definitions of "disability." See appendix A for a discussion of the limitations of estimates of the size of this group.

[14] U.S. Department of Commerce, Bureau of the Census. 1994. "Americans with Disabilities" Statistical Brief SB/94-1.

[15] Since there were several differences between the two surveys, comparisons can be made only for certain segments of the two populations.

Measuring Disabilities for Persons in the Labor Force

As noted in chapter 1, there is no consensus on the definition of disabilities. This means that in examining statistics related to disabilities, it is necessary to understand the definition used in compiling the statistics.

NSF's surveys use a functional definition of disability patterned after one developed for a planned survey of individuals with disabilities developed by the Census Bureau. This measure is based on asking individuals, "What is the USUAL degree of difficulty you have with [specific tasks involving seeing, hearing, walking, and lifting]?"[16] Respondents are given five choices for each response, ranging from "none" to "unable to do." Unless elsewhere noted, having a disability is defined for this survey as having at least moderate difficulty in performing one or more of these tasks. Although this definition was designed to provide a relatively objective measure of disability, it is important to note that not all disabilities are captured by this measure. For example, learning disabilities and behavioral disorders are not included.[17]

[16] The full wording of these alternatives in the survey forms is "SEEING words or letters in ordinary newsprint (with glasses/contact lenses if you usually wear them)," "HEARING what is normally said in conversation with another person (with hearing aid, if you usually wear one)," "WALKING without assistance (human or mechanical) or using stairs," "LIFTING or carrying something as heavy as 10 pounds, such as a bag of groceries."

[17] Additional measures of types of disability were omitted from the surveys due to practical limitations. The disability questions included in the questionnaires were considered burdensome and intrusive by many respondents. The survey designers were concerned that additional questions in this area would have a serious negative impact on the overall response rate and the validity of the surveys. This would be especially true if the surveys requested information on highly sensitive disabilities.

questions for measuring disability that are quite similar to those in the NSF surveys (McNeil, 1993). This provides an opportunity to make some approximate comparisons between the science and engineering population and the larger population.

Comparisons of the two survey results indicate that persons with sight and hearing disabilities are not underrepresented and persons with mobility impairments are underrepresented among scientists and engineers. The Survey of Income and Program Participation found that in 1994–1995, 2.4 percent of the population of 15 to 64 years olds reported that they were unable to see words and letters even when wearing glasses or contact lenses. The comparable figure from the 1995 NSF Surveys was 2.3 percent. In the total population, 2.7 percent were unable to hear normal conversations even when using a hearing aid, compared with 3.0 percent of the scientists and engineers. On the other hand, 4.8 percent of the general population reported being unable to lift a 10-pound bag of groceries, compared with 1.6 percent of the scientists and engineers. Of the total population, 5.2 percent were unable to walk unassisted or climb stairs compared with 1.4 percent of the scientists and engineers. (See appendix table 5-28.)[18 19]

Age Distribution

The proportion of scientists and engineers with disabilities increases with age. More than half became disabled at age 30 or older. (See figure 5-13.) Only 7 percent had been disabled since birth, and 30 percent had been disabled before the age of 20. (See appendix table 5-29.)

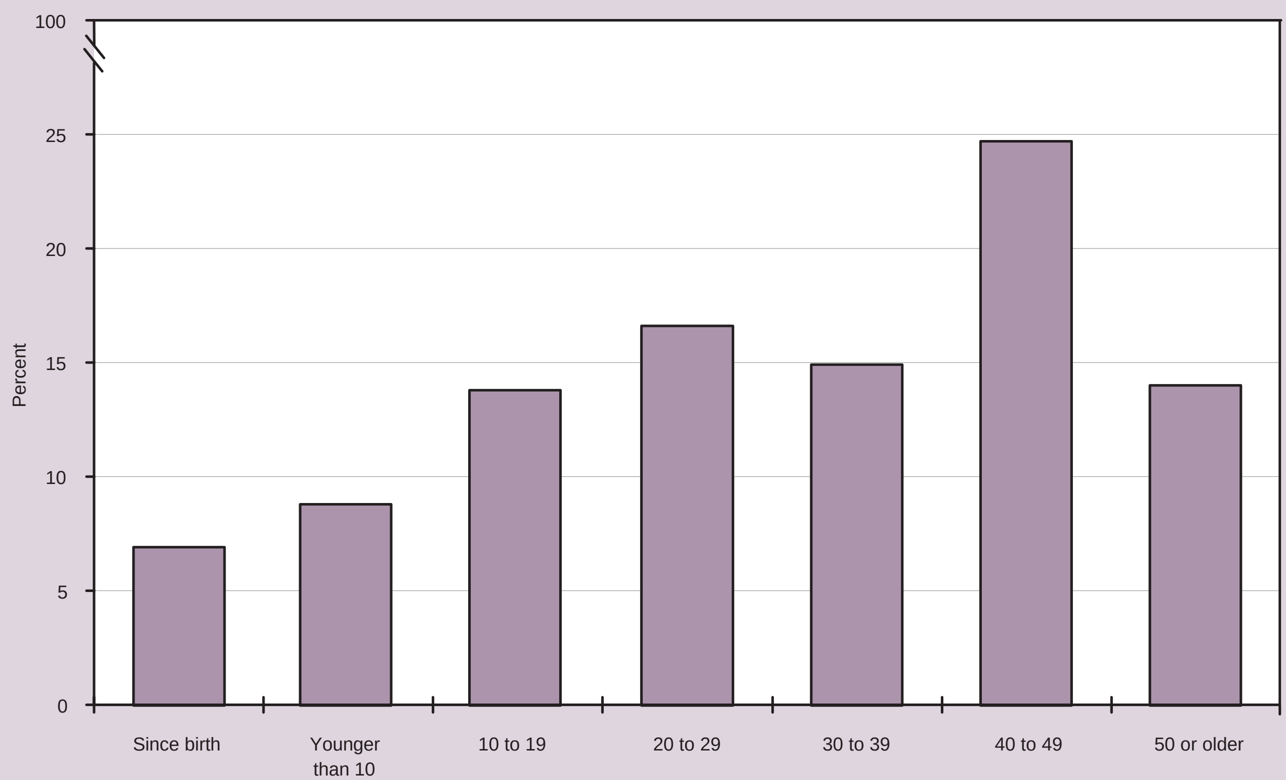
Labor Force Participation, Employment, and Unemployment

The labor force participation rates of scientists and engineers with and without disabilities are quite different. Almost one-third of scientists and engineers

[18] The question used in the SESTAT surveys combined stair climbing and walking, whereas the Survey of Income and Program participation asked about these two activities separately. The rate reported for the latter survey is for the activity with the higher reported disability rate.

[19] Small cell sizes restrict the analysis of types of disability to overall percentages of the science and engineering population.

Figure 5-13.
Percent of scientists and engineers with disabilities who are in the labor force, by age at onset of disability: 1995



See appendix table 5-29.

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with disabilities are out of the labor force, compared with 11 percent of those without disabilities. (See appendix table 5-30 and figure 5-14.) Age accounts for some, but not all, of the differences in labor force participation. Scientists and engineers with disabilities are older than those without disabilities (40 percent of those with disabilities are age 50 or older compared with 20 percent of those without disabilities), and older scientists and engineers are likely to be out of the labor force due to retirements. Age, however, does not explain all of the differences in labor force participation. Within age categories, scientists and engineers with disabilities are still more likely than those without disabilities to be out of the labor force. For example, among those between the ages of 35 and 44, 7 percent of scientists and engineers with disabilities are unemployed or out of the labor force compared with 4 percent of those without disabilities. Among those age 55 or older, 61 percent of scientists and engineers with disabilities are out of the labor force compared with 42 percent of those without disabilities.

Although age accounts for some of the tendency for persons with disabilities to be out of the labor force, chronic illness or permanent disability is also a factor. The primary reason for not working for both persons with and without disabilities was retirement (75 percent versus 60 percent), but 21 percent of persons with disabilities and 2 percent of those without disabilities cited chronic illness or permanent disability. (See appendix table 5-4.)

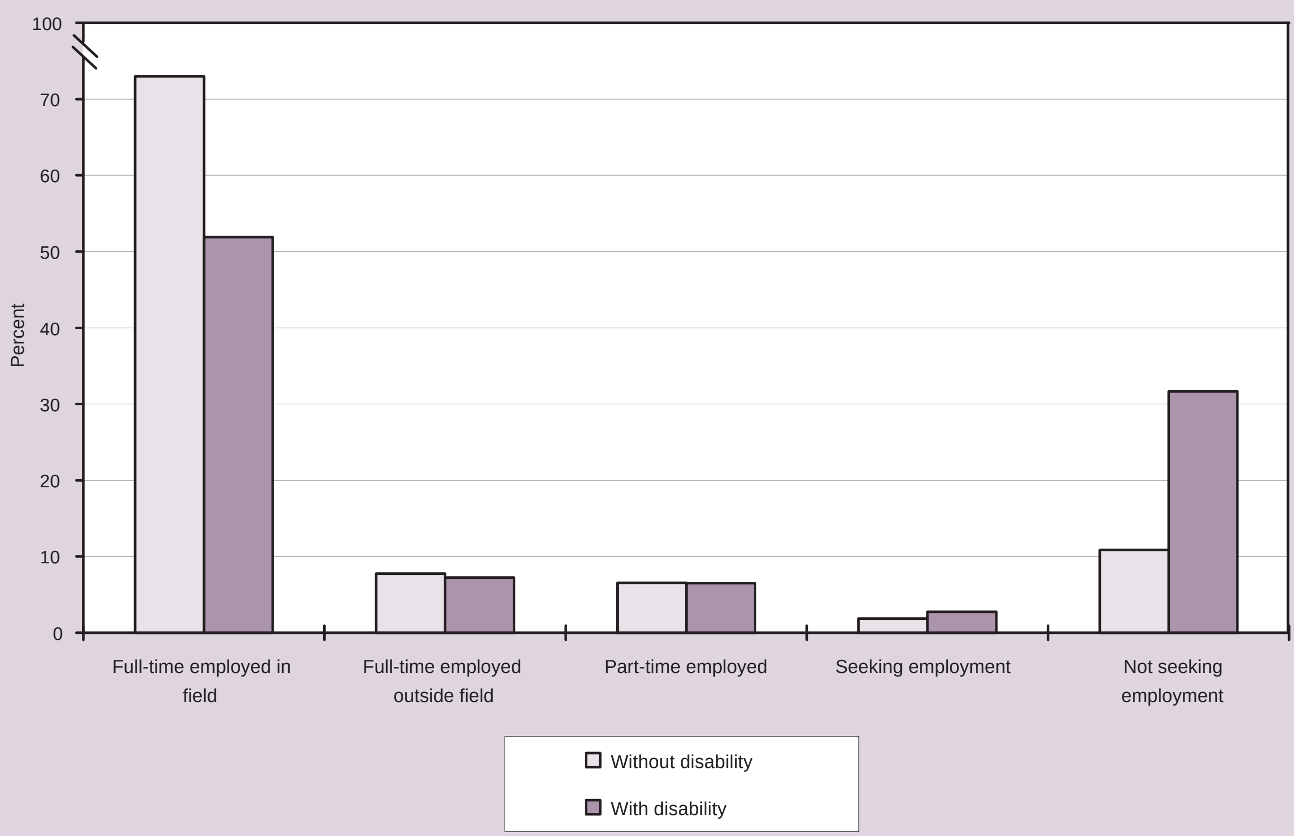
Among those in the labor force, persons with disabilities are more likely than those without disabilities to be unemployed. The 1995 unemployment rate for scientists and engineers with disabilities was 4.0 percent compared to 2.1 percent for those without disabilities. (See appendix table 5-30.)

The percentage of scientists and engineers in the labor force who were employed part time in 1995 was the same for those with and without disabilities (6 percent).

Field of Science and Engineering

Persons with disabilities are not particularly concentrated in certain fields: 30 percent of scientists and

Figure 5-14.
Employment status of scientists and engineers by disability status: 1995



See appendix table 5-30.

Misconceptions Can Limit Job Opportunities

Misconceptions about the ability of those with physical or learning disabilities to succeed in science and engineering persist. These misconceptions deter many young people with disabilities from pursuing careers in science and engineering and can limit the job opportunities for both those who obtain degrees in science and engineering and those who develop disabilities later in life (Woods, 1997). Young people can be discouraged by parents, teachers, and others from pursuing careers in science. As one working chemist with limited vision recalls, "Nobody wanted me to be a chemist...everyone thought it was crazy for a kid, almost blind, to major in chemistry. I had to fight my parents, the school, teachers, guidance counselors, and the state vocational rehabilitation agency" (p. 9). Safety is often the primary concern of parents, teachers, and employers, yet with proper training and accommodations, scientists and engineers with disabilities present no more of a safety hazard than those without disabilities.

According to the American Chemical Society's Committee on Chemists with Disabilities, not all chemists with disabilities require accommodations, and many of those who do require few accommodations, most of which are not costly. For example, making an emergency shower wheelchair accessible can simply require adding a chain. In interviews with a number of working chemists with disabilities, the committee found that the accommodations needed varied depending on the nature of the work and the nature of the disability. Decisions on what accommodations are needed were arrived at jointly between the employee and the employer or the student and the university.

Accommodations used by working chemists varied from simple and common procedures and technologies to more high-tech equipment. Some are as simple as allowing the scientist to work at home; planning in advance; providing simple encouragement and patience while a disabled colleague finds ways to adapt; providing flexible work hours; having access to computers, e-mail, voicemail, and faxes; and making adjustments in height of equipment, desks, valves, switches, ramps, or platforms. Some involve more complicated but nevertheless commonly available technology, such as voice recognition software, TTD, visual alarms, voice-synthesizer cards for computers, and printers that output Braille.

The committee found that attitudes are often the most important accommodation—a focus by both the employee and the employer on what they can rather than what they cannot do.

engineers both with and without disabilities were in computer science and mathematics occupations and 9 percent of both were in physical sciences. (See appendix table 5-31.) Similar proportions of scientists and engineers with and without disabilities were in engineering (41 percent versus 42 percent), in life sciences (8 percent versus 10 percent), and in social sciences (12 percent versus 10 percent).

Educational Background

Scientists and engineers with disabilities do not differ in educational background from those without disabilities: 13 percent of both have the doctorate as their highest degree. (See appendix table 5-31.)

Sector of Employment

Scientists and engineers with disabilities are less likely than those without disabilities to be employed in for-profit business or industry. Fifty-five percent of scientists and engineers with disabilities compared with 62 percent of those without disabilities were employed in for-profit business or industry in 1995. Eighteen percent of those without disabilities and 19 percent of those with disabilities are employed in educational institutions. (See appendix table 5-7.)

Academic Employment

Faculty who have disabilities are more likely than those without disabilities to be full professors and to be tenured. (See appendix tables 5-9 and 5-10.) These differences in rank and tenure between persons with or without disabilities, as was noted in the discussions of women and minorities, can be explained by differences in age. Because incidence of disability increases with age, scientists and engineers with disabilities tend to be older and to have greater years of professional work experience than those without disabilities. Among doctoral scientists and engineers employed full time in 4-year colleges or universities of similar ages, rank and tenure status are more similar. For example, among those between 45 and 54 years old, 70 percent of those with disabilities and 73 percent of those without disabilities are tenured. (See appendix table 5-10.) Similarly, among those in that same age group, 57 percent of faculty both with and without disabilities are full professors.

Science and engineering faculty with disabilities are less likely to have publications than those without disabilities. Twenty-two percent of those with disabilities and 17 percent of those without disabilities had no publications since 1990. (See appendix table 5-11.) Faculty with disabilities had fewer publications than those without disabilities—43 percent of those with disabilities and 46 percent of those without disabilities had 6 or more publications since 1990. Faculty with disabilities (38 percent) were also less likely than those without disabilities (45 percent) to have been supported on federal grants or contracts. (See appendix table 5-12.)

Nonacademic Employment

The type of work that scientists and engineers with disabilities do is similar to the type of work done by those without disabilities. The primary work activity of 37 percent of scientists and engineers with disabilities is research and development, compared to 38 percent of those without disabilities. Twenty-five percent of scientists and engineers with disabilities and 21 percent of those without disabilities are in management or administration. (See appendix table 5-13.) Among those with supervisory responsibilities, persons with and without disabilities have about the same number of subordinates. The average number of subordinates for persons with disabilities is 12 and the average number of subordinates for persons without disabilities is 11. (See appendix table 5-14.)

Persons with disabilities do not differ from those without disabilities in terms of employer size—45 percent of those without disabilities and 46 percent of those with disabilities work for large firms (5,000 or more employees). Four percent of both work for very small firms (fewer than 10 employees). (See appendix table 5-15.)

Natural scientists and engineers with disabilities were less likely than those without disabilities to have patents—32 percent of those with disabilities and 38 percent of those without disabilities had been named as an inventor on a patent since 1990. (See appendix table 5-16.)

Salaries

Median salaries of scientists and engineers with disabilities do not differ substantially from median salaries for those without disabilities. Among all scientists and engineers, the median salary for those with disabilities is $51,000; for those without disabilities, it is $50,000. Salaries differ little within fields and age groups as well. For example, the median salary for engineers with bachelor's degrees and between the ages of 20 and 29 is $41,000 for those with disabilities and $38,000 for those without disabilities. Among those age 50 or older, the median salary for engineers with disabilities is $60,000 and the median salary for engineers without disabilities is $61,000. (See appendix table 5-32.)

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